INDOOR AIR MONITOR
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Naval Facilities Engineering Service Center
Environmental Department
NAVOSH Air Branch
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NFESC AND NAVOSH AIR BRANCH

The Naval Facilities Engineering Service Center (NFESC) is the Navy's center for specialized facilities engineering and technology. NFESC was established on October 1, 1993, and consolidated the missions of six Naval Facilities Engineering Command (NAVFAC) components. The new organization was created to capitalize on streamlining and efficiency. Expertise is better shared in related engineering areas--overhead and duplicative functions were eliminated. Because NFESC is largely a Navy Working Capital Fund (NWCF) organization, the new structure keeps these important products and services viable and competitive, ultimately the best value for our customers' dollar. Services and products include:

- Ocean Facilities
- Shore Facilities
- Environmental Services
- Energy & Utilities
- Amphibious & Expeditionary Logistics
- Centers of Expertise

The NAVOSH Air Branch (ESC425) provides engineering support for the Navy and Marine Corps and other DOD and federal entities in the following areas:

1. Asbestos Program: The goal of the asbestos program is to help NAVFAC's engineering field divisions (EFD); engineering field activities (EFA); public work centers (PWC); Naval Facilities Engineering Command (NAVFAC); and Navy and Marine Corps activities meet best engineering practices for asbestos management. We provide:

- Technical consultation during surveys, assessments, and abatement actions

- Guidance in developing a "scope of work" for inventories and operations and maintenance (O&M) plans
- On-site development of O&M plans to manage sites with asbestos containing material
- Asbestos building re-inspection

2. Industrial Ventilation Program: Ventilation system evaluation is available for all industrial processes, which could affect the health and safety of employees. These include, but are not limited, to traditional industrial processes such as electroplating, metalworking, woodworking, painting, abrasive blasting, and non-industrial processes such as indoor firing ranges, pesticide shops, laboratories, hospital morgues, and ethylene oxide sterilizers. We provide the following services:

- Industrial ventilation design, installation, and design reviews (concept through as-builds)
- On-site quality assurance during construction of IV systems
- System acceptance testing for NAVOSH compliance
- System baseline and troubleshooting testing
- Re-testing and follow-up technical support
- Produce a technical report detailing system performance, recommended corrective actions and preliminary cost estimate
- On-site training.

3. Other Services

- Lead Management
- Radon Inspection
- Noise Abatement

Funding from the Chief of Naval Operation's Naval Occupational Safety and Health Program is available for a limited number of projects. Most projects are performed on a reimbursable basis.
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HAZARD CONTROL VENTILATION

There are two types of hazard control ventilation: dilution ventilation and local exhaust ventilation. Dilution ventilation should be limited to controlling low hazard contaminants and nuisance dust. In most cases local exhaust is required to control the hazard. Designing and installing a ventilation system is complex. Improper designs have resulted in exposing workers to unnecessary risks. All ventilation to control hazards should comply with the design recommendations set forth in the latest edition of *Industrial Ventilation, A Manual of Recommended Practice* published by the American Conference of Governmental Industrial

Hygienists. Modification to existing ventilation systems should be done only by a professional designer. Many do-it-yourself modifications result in increasing the hazard. The following recommendations are general guidelines for dilution and local exhaust ventilation.

1. Dilution ventilation. Dilution ventilation allows the contaminants to mix with ambient air while introducing clean air from outside to dilute the contaminant concentration. Dilution ventilation is not as satisfactory for health hazard control as is local exhaust ventilation. Dilution ventilation system design principles are as follows:

a. From available data select the amount of air required for satisfactory contaminant dilution

b. Locate the exhaust opening as close to the contamination source as possible

c. Locate the air supply and exhaust opening so the air passes through the contamination zone

d. Replace exhaust air with a replacement (supply) air system

The use of dilution ventilation for health has four limiting factors: (1) The quantity of contaminant generated must not be too great or the required airflow rate will be impractical; (2) Workers must be far enough away from the contaminant source or the evolution of contaminant must be in sufficiently low concentrations; (3) The toxicity of the contaminant must be low; and (4) The evolution of contaminants must be reasonably uniform.

2. Local Exhaust Ventilation. Local exhaust ventilation captures the contaminant at its source and removes it before it mixes with ambient air. Local exhaust ventilation systems are the primary engineering control for limiting workplace exposure. When designing a local exhaust system consider the following:

a. Enclose the contamination source if at all possible. If enclosing is not possible because of access or space requirement, locate the source as close to the hood opening as possible.

b. Locate the hood to avoid doorways, high traffic areas, windows, or any other structure that might create airflow disruptions.

c. Use flanges and baffles to reduce turbulence at the hood opening and improve efficiency.

e. Pay attention to air distribution across the hood face. Slots, plenum, and take-off (transition) are most commonly used to provide uniform exhaust airflow across the hood face.

f. Design and construct the ducting to comply with the recommendations set forth in the most recent edition of *Industrial Ventilation, A Manual of Recommended Practices*.

g. Consult with local specialists, early in the design phase, to ensure appropriate selection of air pollution control system.

h. Locate the fan outside the building.

i. Locate exhaust stacks away from air intakes. Stacks should project above the roofline.

A complete ventilation program must consider both the supply and the exhaust systems. In most industrial applications, a negative pressure is required to control or isolate contaminants in a specific area of the overall plant. Without a supply system, air will enter the plant in an uncontrolled manner through cracks, windows, and doorways, causing unsatisfactory conditions in many aspects including safety, comfort, maintenance, as well as production.

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ASBESTOS FINAL INSPECTION

The American Society for Testing and Materials (ASTM) standard "Practices For Visual Inspection of Asbestos Abatement Projects" (E 1368-90) specifies procedures for conducting a visual inspection at the end of an asbestos abatement project. After clean up, a visual inspection is required prior to final air sampling and releasing asbestos controlled areas for unrestricted access. Air samples shall not be taken until the final visual inspection is passed. The inspection should take place prior to any sealer or encapsulate (lockdown) is applied to substances. The objective is to determine the presence of visible debris or residue at project completion. Any residue, dust, or debris found during the final inspection is assumed to contain asbestos, and the area must be re-cleaned.

The inspector should have experience in asbestos abatement and have all necessary qualifications to enter the regulated area. For small-scale operations, a foreman or supervisor may perform the visual inspection.

The visual inspection shall be performed in accordance with the following requirements:

1. Enter all spaces where asbestos abatement was performed and get close enough to touch the surface from which the asbestos was removed.

2. Deliberately disturb the substrate to release any residual dust or debris by brushing or wiping. This can enhance visibility if the asbestos is similar in appearance to the substrate. This can be further enhanced with a narrow beamed flashlight.

3. Use a clean cloth or white glove and wipe it across the surface and inspect it for evidence of residue.

4. Pay special attention to hard or difficult to reach areas (i.e., spaces between steel beams, roof or ceiling frames, air duct flanges, etc.).

5. Pay special attention to permanent fixtures of the work area, such as walls, ducts, conduits, pipes, and ceiling tile grid bars.

6. Pay attention to folds, creases, and crevices in plastic isolation barriers, and taped seams where water and debris can accumulate and be concealed.

7. Use a small screwdriver or other sharp tools to poke into crevices, cracks, bolt threads, etc.

8. If debris or residue is found during the final work area inspection, re-clean and re-inspect until all residue, dust, and debris are removed.

9. If the area fails final clearing air monitoring, the area will must be re-inspected.

10. The competent person and a worker should accompany the inspector on any inspection. When surface debris is found the worker can perform wet cleaning methods or vacuum the surface. Note: If the inspectors believe that they are becoming a part of the final cleaning operation, they may terminate the inspection and direct a re-cleaning of the entire area before repeating the inspection.

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REGULATORY STANDARDS OR RECOMMENDED PRACTICES FOR LABORATORY VENTILATION

1. ANSI/AHA Z9.5-2003 American National Standard Laboratory Ventilation--First published in 1992, includes new chapters on performance tests, air cleaning, preventative maintenance, and work practices, as well as five appendices such as "Selecting Laboratory Stack Designs" and an audit form. Available from the AIHA website at http://www.aiha.org/marketplace.htm or by phone at 301-283-3064, stock number 437-EQ-01.

2. International Mechanical Code--Established by the International Code Council (ICC) is increasingly being used in the United States. The ICC was established in 1994 as a nonprofit organization dedicated to developing a single set of comprehensive and coordinated national model construction codes. The ICC founders are Building Officials and Code Administrators International, Inc. (BOCA); International Conference of Building Officials (ICBO); and Southern Building Code Congress International, Inc. (SBCCI). Since the early part of the last century, these nonprofit organizations developed the three separate sets of model codes used throughout the U.S. The International Codes were created due to the disparity in the model codes in use in the U.S. In the past, it was difficult for building industry professionals to move into different regions within the U.S., much less into an international environment.

3. OSHA 1910.1450--Occupational Exposure to Hazardous Chemicals in Laboratories--Briefly mentions lab ventilation in the main text and a bit more in the non-mandatory appendices.

4. ASHRAE 110-1995 Method of Testing the Performance of Laboratory Hoods--Can be ordered through the ASHRAE online bookstore. This is being revised, but the new version may not be published for several years. Issues being reviewed include dynamic testing, breathing zone height, and correlation with exposure.

5. ACGIH Industrial Ventilation Manual, 24th Edition, 2001-- Provides information on supply air effects, recommended face velocities, work practices, perchloric acid hoods, and biological safety cabinets.

6. NFPA 45--Standard on Fire Protection for Laboratories Using Chemicals, 2000 edition, Chapter 6 is titled Laboratory Ventilating Systems and Hood Requirements. Order from http://catalog.nfpa.org/.

7. The Scientific Equipment and Furniture Association (SEFA) --As a trade association of hood manufacturers, its website at http://www.sefalabs.com is a good place to start. Click on “Products & Services” to get a list of fume hood manufacturers and other ventilated lab equipment. Click on “library,” "standards" and then "fume hoods" to download their standard on Laboratory Fume Hoods Recommended Practice. This standard (SEFA 1.2 1996) includes the non-tracer gas portion of ASHRAE 110.

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INDUSTRIAL VENTILATION TRAINING OPPORTUNITIES

The NAVOSH Air Branch of the NFESC is frequently asked about the Industrial Ventilation Design Testing and Troubleshooting course. We typically offer two classes a year, usually in a geographic area that we have not visited, or in primary Navy industrial areas. We also offer a short course on Testing and Troubleshooting at the yearly Navy Occupational Health and Preventive Medicine Workshop.

Below is a list of several other entities that give short courses. This is not an endorsement, although our team members attended one or more of the classes.

- University of Wisconsin – Madison, WI, offers a number of engineering courses including HVAC for Industrial Facilities, Testing Adjusting and Balancing (TAB), Variable Speed Drive Motors, HVAC Piping, Laboratory Building Systems, etc. Contact: 800-462-0876, custserc@epd.engr.wisc.edu.

- Industrial Ventilation Conference(s).
    - University of Alabama, Birmingham, 20 to 23 October 2003 www.eng.uab.edu/epd
    - Michigan Stare University, East Lansing, 8 to 12 February 2004, 517/322-6560
    - North Carolina State, 19 to 24 April 2004, 919/233-8400
    - University of Nevada/Las Vegas, 7 to 10 June 2004, 702/895-3598 www.eng.uab.edu/epd

  Students are divided into different knowledge levels and needs, e.g. Intermediate Design, Non-standard Air, Advanced Systems Design, Plant Engineering, etc. Frequently there are add-on TAB or Troubleshooting classes. A team of designers, contractors, end users and equipment manufacturers teach the courses. They do not market at the conference but they can discuss their product if you ask outside of class time. All conference courses are based on the ACGIH IV manual.

- A number of other people offer courses that address specific issues upon request including, but not limited to:
    - Gerry Knutson http://www.knutsonventilation.com,

- Steve Guffey http://industrialventilation.net/ and
- D. Jeff Burton http://www.eburton.com/.

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